Six Layers: A Framework for More Sustainable Building

Duluth Energy Design Conference
27 February 2019

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Learning Objectives

1. Apply a practical, holistic future-oriented definition of sustainability to building.

2. Review the basic concepts of integrated design.


5. Think about how the hierarchy in the layers can impact the longevity and usefulness of a building, both good and bad.

6. Understand the significance of the 6 Layers framework as a guide to help inform decisions in design and construction.
“Well, the first thing is that buildings consume a lot of resources. And I think most of us know that, but they don’t realize the extent to which buildings use resources. It’s the most consumptive kind of industry on the planet.

… And they also pollute, displace, and destroy habitats.”

-Professor John Straube, University of Waterloo, 2009
Sustainability

“What we need to learn is to make not just any thing, but (to make) the right thing, and make it to last for as long as possible.”

John Ehrenfeld, “Flourishing – A Frank Conversation about Sustainability”
“The Right Thing” according to the Whole Building Design Guide (c.2018)

“The main objectives of sustainable design are to reduce, or completely avoid, depletion of critical resources like energy, water, land, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle; and create built environments that are livable, comfortable, safe, and productive.”

https://www.wbdg.org/design-objectives/sustainable
The Right Thing, Simplified

Image from circularecology.com
Integrated Design

"When we try to pick out anything by itself, we find it hitched to everything else in the Universe."

- John Muir (1838-1914), engineer, naturalist
Think critically and early
Critical Thinking

Analysis

Rigor

Imagination

Common Sense
HOW BUILDINGS LEARN
What happens after they’re built

New Orleans, 1857
The same two buildings, 1993

STEWART BRAND
creator of THE WHOLE EARTH CATALOG
Theory of Shearing Layers

Image from communionarchitect.com
Shearing Layers of Change

“A building properly conceived is several layers of longevity of built components.”

Frank Duffy, as told to Stewart Brand, “How Buildings Learn”

“Because of the different rates of change of its components, a building is always tearing itself apart.”

Steward Brand, “How Buildings Learn”
“Thinking about buildings in this time-laden way is very practical. As a designer you avoid such classic mistakes as solving a five-minute problem with a fifty-year solution, or vice versa.”

Frank Duffy, “How Buildings Learn”
Significance

The approach to every layer has implications for long-term economic, social and environmental impact...

In essence, Sustainability.
Site

- Essentially eternal
- Geographic location
- Land features, boundaries
- Surrounding context
“Site is eternal.”
Frank Duffy, “How Buildings Learn” by Steward Brand
There is a hierarchy to the layers

What is done initially to the first two layers, Site and Structure, is the least easily changed after the initial construction and may have the longest impact (positive or negative).
What we choose to develop matters.
Location, Location, Location

Image from www.financial-planning.com
60 - 100 years or more
Foundation
Load bearing structure
Longest lasting of the built elements
Insulation and services may be embedded here
Placing a building has lasting impact

Good water management begins with the SITE.
Keep the Structure Strong and Durable

Done Right the First Time

Fixing Things

Image from concreteconstruction.net
It’s only easy to insulate under the foundation once.
• 20 – 100 years
• Water management/protective layer
• Exterior surfaces: roof, siding, sheathing, windows
• Not all elements wear out at the same rate
• Insulation and services may be embedded here
The “Skin” often has the biggest impact on long-term durability, occupant comfort and building energy performance.
More Than Skin Deep
Integrated Design in Practice

“How a room is heated depends on how it relates to the heating and cooling Services, which depend on the energy efficiency of the Skin, which depends on the constraints of the Structure.”

Steward Brand, “How Buildings Learn”
Services

- 7-30 + years
- Plumbing, heating, cooling, ventilation, electrical
- Distribution systems harder to change than plants
- Replaced from wear or obsolescence
- Kitchens and Baths are most remodeled rooms
Avoiding obsolescence

“The longevity of buildings is often determined by how well they can absorb new Services technology.”

Stewart Brand, How Buildings Learn
Access to Services Aids Adaptability
Does the Investment Match the Lifespan?
• 5 – 40 years

• Considered mutable, changeable without changing structure, services, or skin

• The building interior:
  • Partitions, surface finishes, fixtures, doors
Often a big investment, and often changed.

Image from www.batchelor-resort.com
• Impermanent
• Things easily movable
• Most frequently changed by occupant
• Appliances, lamps, electronics, furniture, art
What doesn’t last goes somewhere.

“The opposite of adaptation in buildings is graceless turnover.”

Steward Brand, “How Buildings Learn”
The Significance of the Framework: Context and Perspective
Sustainability Takes the Long View

“An adaptive building has to allow slippage between the differently-paced systems of Site, Structure, Skin, Service, Space Plan, and Stuff.

... Embedding the systems together may look efficient at first, but over time it is the opposite, and destructive as well.”

Stewart Brand, “How Buildings Learn”
Walls are Inherently Complicated

- They may be structural.
- They connect to foundation, floor, and roof.
- We cut holes in them.
- We attach things to the outside of them.
- We attach things to the inside of them.
- They may contain MEP systems.
Structure, Skin and Space Collide
Separate Structure, Plan for Change

- Create cavities for services:
  - Walls
  - Soffits
  - Dropped ceilings
  - Chases

- Allow for window replacement without dismantling surrounding finishes

- Don’t embed exterior elements into interior elements (decks, awnings)

- Expose some mechanicals
Toward Creating an Adaptive Building

Wolf Haus wall with Service Cavity [www.wolf-haus.de](http://www.wolf-haus.de)

Ecocor’s Passiv Wall [www.ecocor.us/walls](http://www.ecocor.us/walls)
Using the Framework: Questions to Ask

1. Which layer(s) will this choice impact?
2. Are we investing enough in Site and Structure?
3. Are we over-investing in Space and Stuff?
4. Will the Services be easily accessible for repair, maintenance and replacement?
5. Do the details support longevity of structure?
6. How does the design allow for alteration?
“Age plus adaptivity is what makes a building come to be loved.”

Steward Brand, “How Buildings Learn”
Resources

• Bioregional  https://www.bioregional.com/bedzed/
• Green Building Advisor https://www.greenbuildingadvisor.com/
• Canada Green Building Council  https://www.cagbc.org/
• U.S. Green Building Council  https://new.usgbc.org/
• Building Green  https://www.buildinggreen.com/
• Myths about Green Building
• Ecocor  https://www.ecocor.us/

Good Books

• How Buildings Learn/What happens after they’re built by Stewart Brand
• The Timeless Way of Building by Christopher Alexander
Thank you.

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